UNIFORM TEMPERATURE THERMOCOUPLE REFERENCE

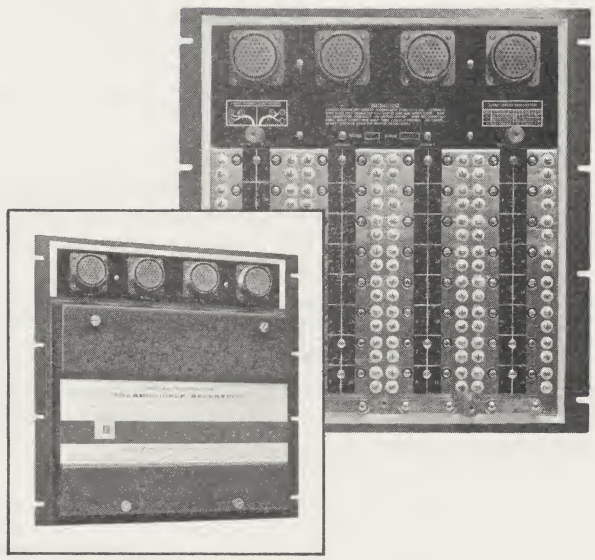
APPLICATIONS

Designed primarily for computerized data acquisition readout.

Research -- Large systems where multiple T/C inputs are scanned rapidly by a computer and where accuracy of the temperature measurement is critical.

Industry -- For process control in a variety of chemical, oil, and industrial applications where multiple temperatures are simultaneously monitored and/or controlled and fed into a computer data logging system.

Any applications requiring low cost, fully automatic operation, high speed scanning of many temperature points, and highly accurate temperature measurement.



(UTR Shown With and Without Terminal Cover)

HOW IT WORKS

The Uniform Temperature Reference (UTR) is a passive device, i.e. not controlled to a specific temperature as is the case with the typical thermocouple reference system. Instead, measuring thermocouples are connected to copper terminals on a panel; these terminals form the cold junctions of the thermocouple circuit. All terminals on the panel are maintained at uniform temperature within an enclosure and the panel temperature is monitored by a thermocouple or other transducer.

The computer "reads" each temperature measuring signal as a temperature relative to that of the UTR panel, and adds to it the temperature of the UTR panel relative to a reference standard as signaled by the monitor. Programming the monitor is done only once when the program is initially prepared and from then on the resultant data of the combined measuring and monitoring signals automatically result in the mathematical equivalent of the temperatures being measured.

FEATURES

Low Cost -- Capital expenditure for systems using multiple UTR's is less than conventional controlled temperature references of comparable capacity.

Flexibility -- Accepts any thermocouple material combination interchangeably and intermix any combinations simultaneously.

Accuracy -- Of commercially available thermocouple references, only our "automatic ice-bath" Ice-Point Thermocouple Reference Systems equal the accuracy of the UTR.

Fail Safe Operation -- It is a passive device with no working parts.

JOSEPH KAYE & COMPANY, INC.
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

SPECIFICATIONS

Model Designation: UTR

Channel Capacity: 64 (63 channels if one set of terminals is used for connection of a monitoring thermocouple).

Accuracy: Total cumulative error (input to output) less than 0.1°F for a linear 20°F per hour ambient temperature change.

Uniformity: (between any two junctions and between any junction and a monitoring junction) 0.1°F for a linear 20°F per hour ambient temperature change; 0.02°F for a linear 5°F per hour ambient temperature change; deviation will approach zero as ambient temperature is controlled to smaller rates of change.

Thermocouple Materials: Accepts any thermocouple type and any mix.

Input Wire Size: Up to 16 AWG.

Outputs: Each channel supplied with provision for individual copper transmission lines to the readout equipment.

Internal Noise: None.

Resistance: 1000 megohms minimum channel-to-channel and channel-to-ground.

Input Terminals: Gold-plated screw terminals.

Output Terminals: 4 MS connectors containing gold-plated contacts.

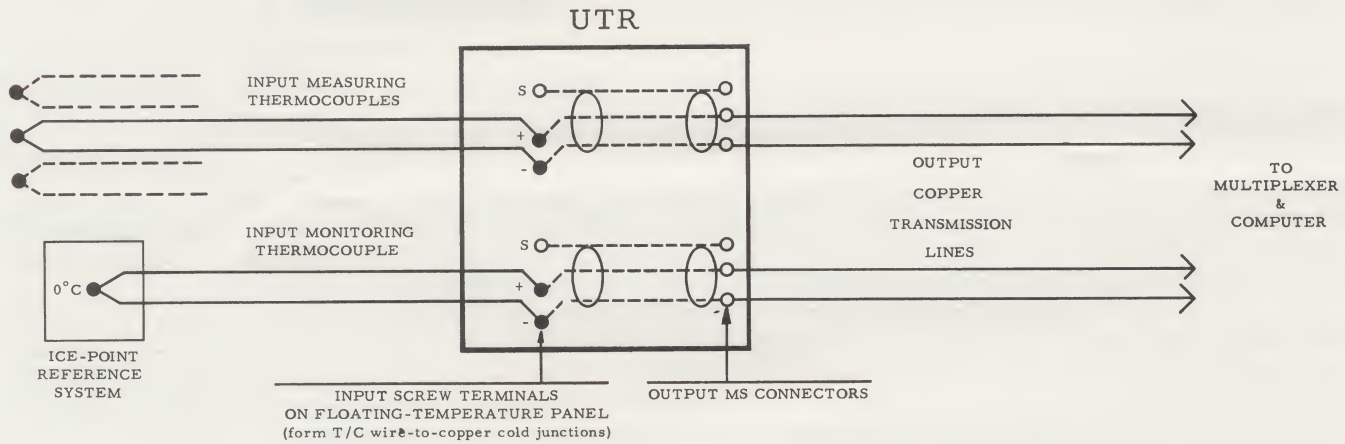
Mating Output MS Cable Connectors: Furnished as standard equipment with cable clamps.

Shielding: Each channel is individually shielded and provided with input and output terminals for connection of shield carry-through. Each shield is electrically insulated from instrument.

Mounting: Standard 19" rack panel mounted. Unit can be mounted with terminals and connectors accessible either from the front or rear of the rack.

Dimensions: 19" wide x 19 1/4" high; 2 3/8" projection front and rear of mounting surface.

Shipping Weight: 23 lbs.



COMPANION THERMOCOUPLE REFERENCE SYSTEMS
For Use With Monitoring Thermocouple

Each UTR's floating temperature is monitored by a single thermocouple as pictured above which, in turn, must be referenced at a known temperature. We recommend the use of a Joseph Kaye "automatic ice-bath" in order to realize system accuracy commensurate with the inherent capability of the UTR. One monitoring thermocouple must be used for each UTR in the system. A single Ice-Point Reference System may be used to monitor all UTR's in a temperature measuring system. One channel in the Ice-Point Reference System will be required for each UTR being monitored.

Send for Specification Sheet Numbers 202B, 205, and 209.

Printed in U.S.A.

THERMOCOUPLE REFERENCE SYSTEM
GENERAL INFORMATION

Bulletin #210

Principle of Operation

Solid-state devices, cooled by thermoelectricity (the Peltier effect). The hearts of the instruments consist of an hermetically sealed chamber of water in which is immersed the reference thermocouples or the reference immersion well (depending on model). The reference temperature of 0°C is established by the physical equilibrium of ice and water. The ice-water equilibrium is sustained by a thermoelectric cooler automatically controlled by a bellows-microswitch sensing mechanism which responds to the relative volumes of ice and water coexisting in the hermetic cell. Thus, the reference thermocouples, or reference well, are continuously surrounded by an equilibrium ice-water mixture.

Temperature Control

By definition, the equilibrium temperature of ice and air-saturated water at normal atmospheric pressure is 0°C. Joseph Kaye automatic reference systems provide this primary reference point by maintaining an equilibrium mixture of ice and air-saturated water in an hermetically sealed chamber. Control of the ice content is accomplished at constant pressure and constant temperature by sensing volumetric change of the chamber's content.

These systems require no secondary means of control such as sensing a change in the resistance of an element caused by a change in temperature. Thus, there is no inherent requirement for a temperature change in order to produce a control signal. In addition, the equilibrium temperature of ice and water is fundamentally constant whereas the electrical resistance of an element is subject to variation with time.

Accuracy and Stability

Unequaled by any other references such as the more conventional elevated-temperature resistance-heated ovens, compensating devices commonly incorporated in recorders, and ice-bath . . . operation achieved by utilization of natural physical phenomenon . . . not dependent on the capabilities of complex electronic temperature control . . . absolutely no drift . . . eliminates the problem of an unstable transient reference temperature inherent in other types of temperature references.

NBS Traceability

JKCo Ice-Point Thermocouple Reference Systems are measured against Company "standards" which in turn are calibrated by the National Bureau of Standards.

2150, 2120, PRJL, and PRJR Series . . . since these models contain ISA Premium grade wire which deviates slightly from NBS Standards, traceability is meaningful only when a model is furnished with JKCo calibration.

2110 and RCS Series . . . accuracy specifications are guaranteed traceable to the National Bureau of Standards.

Convenience

Ice-Point Reference enables temperatures to be read directly from standard NBS thermocouple conversion emf tables . . . eliminates the necessity of making and maintaining an ice-bath or the messiness associated with a triple-point apparatus.

JOSEPH KAYE & COMPANY, INC.
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

Fully Automatic Operation

No adjustment or compensation necessary. Once turned on, the instrument references at 0°C with no attention required. It will reference continuously.

Because of low power consumption, ideal for continuous 24-hour service. Fully solid-state operation insures years of trouble-free performance. No maintenance or field service is required. Cycling pilot light provides fool-proof indication that the reference temperature is at 0°C.

No-power Operation

All models may be used for short periods of time with cooling power turned off without deterioration of ice-point reference temperature.

Even though all models are well shielded and designed for minimal noise introduction in T/C circuits, it may be desirable to turn off the instrument when calibrating platinum resistance elements which are affected adversely by electrical fields or for any application where the slightest electrical noise is objectionable.

Precision

Accuracy of the reference system is a function of two factors; stability of reference temperature and uniformity of thermocouple wire used:

Stability of reference temperature -- The reference temperature is maintained at a stability of better than ± 0.025°C. Ideal for use in the rapid scanning of multiple temperatures by automatic data collection systems.

Uniformity of thermocouple wire -- Commercially obtainable thermocouple wire does not match the NBS curve exactly, thus the possibility exists of mismatch between wire incorporated in the reference system and wire used in the remainder of the circuit. Deviations from NBS Standards may be nullified if the entire installation (including reference system) is calibrated and a correction factor used. Calibration service is available for Joseph Kaye Reference Systems that provides a correction factor which, when incorporated in the temperature reading, eliminates the above mentioned deviations of T/C materials incorporated in the instrument. In a completely calibrated installation, total reference system deviation from 0°C does not exceed 0.05°C. When used with ISA Standard wire in a non-calibrated installation, reference system accuracy meets ISA Standard specifications +0.05°C.

Thermocouple Materials

Premium grade wire used exclusively

Six (6) standard types of thermocouple materials are available:

Copper/constantan	Chromel/constantan
Iron/constantan	Platinum/platinum-10% rhodium
Chromel/alumel	Platinum/platinum-13% rhodium

Other thermocouple materials will be furnished when specified at a slight increase in cost. Any combination of T/C materials may be incorporated in a single reference system.

Copper Transmission Lines

2150 Series and 2120 Series available with or without provision for copper transmission lines; PRJL and PRJR Series available with this provision only. This provision converts each positive and negative leg to copper at ice-point.

Copper transmission lines have the following advantages: they save the cost of running long leads of expensive thermocouple material. They are recommended for applications where extreme accuracy is desired, since they eliminate possible sources of spurious emf's due to the creation of thermocouple junctions at ambient at the connections to the readout equipment.

In those models with provision for copper transmission lines, each reference channel consists of two (2) thermocouples at ice-point with each having one leg of copper and one leg of T/C material. Each reference channel, therefore, is supplied with four (4) terminals; one pair is for connection of the measuring thermocouple to the reference system; the second pair is provided for connection of copper transmission lines to the recording equipment.

MODEL 2110
ICE-POINT REFERENCE STANDARD

"THE AUTOMATIC ICE-BATH"

The original reference system utilizing the actual equilibrium of ice and water to maintain a true ice-point reference temperature. Not a simulated device . . . fully automatic . . . ice-point maintained continuously without the deterioration typical of common ice-baths.

(patented)

WHAT IT IS

Bench type reference which maintains an immersion well at 0°C continuously. The top of the well is exposed to allow the insertion of thermocouples or other types of small temperature sensing devices, thus providing a constant-temperature reference source for the sensors.

APPLICATIONS

Research Laboratory . . . Replaces common ice-bath for precision work.

Standards Laboratory . . . A reference standard for calibrating thermocouples, thermocouple wire, and for the calibration of instruments used in thermocouple thermometry.

FEATURES

Precision . . . An immersion well-type thermocouple reference has several advantages over reference systems with built-in thermocouples and thermocouple terminals. Eliminates intermediate connections which can introduce spurious errors in the measuring circuit. Eliminates necessity for matching external and internal thermocouple wires, thus preventing secondary thermocouples in the circuit due to wire mismatch.

ICE POINT

JOSEPH KAYE & COMPANY, INC
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

Operating Principle . . . By definition, the equilibrium temperature of ice and air-saturated water at normal atmospheric pressure is 0°C. Joseph Kaye automatic reference systems provide this primary reference point by maintaining an equilibrium mixture of ice and air-saturated water in an hermetically sealed chamber.

Control of the ice content is accomplished at constant pressure and constant temperature by sensing volumetric change of the chamber's content.

These systems require no secondary means of control such as sensing a change in the resistance of an element caused by a change in temperature. Thus, there is no inherent requirement for a temperature change in order to produce a control signal. In addition, the equilibrium temperature of ice and water is fundamentally constant whereas the electrical resistance of an element is subject to variation with time.

Automatic Operation . . . Fully automatic operation . . . once turned on, the reference never needs attention or maintenance.

Versatility . . . Complete flexibility to interchange thermocouples or other sensors in the reference well . . . any combination of thermocouple material can be readily interchanged.

Portability . . . Furnished with carrying handle for in-plant temperature measurements at various locations.

Reference Well Cooling . . . The reference well is cooled along its length, thus effectively providing ice-point immersion for the entire stated immersion depth . . . simulates practical immersion depth of the common ice-bath or triple-point apparatus.

Reference Thermocouple Capacity . . . Several thermocouples can be inserted in the well simultaneously. However, care should be taken not to overload the well. Stated accuracy does not take into account lead conduction error of inserted probes (a function of the thermal conductivity of the inserted probes plus ambient temperature). Lead conduction error will be approximately equal to that experienced by inserting a probe of the same thermal conductivity to the same immersion depth in an ice-bath or triple-point apparatus.

SPECIFICATIONS

Reference Temperature: 0°C.
Reference Temperature Stability: ± 0.025°C (short-term peak-to-peak and long-term drift combined).
NBS Traceability: Reference Temperature Accuracy traceable to the National Bureau of Standards with certificate furnished.
Reference Temperature Indication: Cycling pilot light provides fool-proof indication that reference temperature is at 0°C.
Capacity: One reference well (See "Reference Thermocouple Capacity" above).
Reference Well Dimensions: Well I.D. -- 1/4".
Immersion Depth -- 6".
Thermocouple Materials: Will accept any mixture of T/C combinations.
Environment: Operable at ambient temperatures between 35 - 100°F.
Noise: 1/2 μv peak-to-peak (typical); 1 μv peak-to-peak (maximum).
Input Power: 117 volts, 60 cycle AC, single phase.
Power Consumption: 75 watts (maximum).
Controls: On-Off switch, cycling pilot light, fuse.
Mounting: Shelf model with carrying handle.
Dimensions: 6 3/8" wide x 11 5/8" deep x 10 1/8" high.
Shipping Weight: 20 lbs.

3M-866

Printed In U.S.A.

2150 AND 2120 SERIES
ICE-POINT THERMOCOUPLE REFERENCE SYSTEMS

"THE AUTOMATIC ICE-BATH"

The original reference system utilizing the actual equilibrium of ice and water to maintain a true ice-point reference temperature. Not a simulated device . . . fully automatic . . . ice-point maintained continuously without the deterioration typical of common ice-baths.

(patented)

WHAT IT IS

The 2150 Series is a bench type Ice-Point Reference of one to eight channel capacity with built-in reference thermocouples and binding post connections.

The 2120 Series is a rack-mounting Ice-Point Reference of one to eight channel capacity with built-in reference thermocouples and binding post or screw terminal connections.

APPLICATIONS

These instruments are for general research applications where a high degree of convenience, reliability and precision are valued.

ICE POINT

JOSEPH KAYE & COMPANY, INC.
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

The 2150 Series is our most popular ice-point reference and is used as a replacement for the common ice-bath.

The 2120 Series provides the same utility as the 2150 where rack mounting is desired . . . ideal for use in conjunction with rack-mounted recorder or potentiometer . . . replaces much less accurate cold junction compensators normally used with recorders.

FEATURES

Operating Principle . . . By definition, the equilibrium temperature of ice and air-saturated water at normal atmospheric pressure is 0° C. Joseph Kaye automatic reference systems provide this primary reference point by maintaining an equilibrium mixture of ice and air-saturated water in an hermetically sealed chamber.

Control of the ice content is accomplished at constant pressure and constant temperature by sensing volumetric change of the chamber's content.

These systems require no secondary means of control such as sensing a change in the resistance of an element caused by a change in temperature. Thus, there is no inherent requirement for a temperature change in order to produce a control signal. In addition, the equilibrium temperature of ice and water is fundamentally constant whereas the electrical resistance of an element is subject to variation with time.

Automatic Operation . . . Fully automatic operation . . . once turned on, the reference never needs attention or maintenance.

SPECIFICATIONS

Reference Temperature: 0° C.
Reference Temperature Stability: ± 0.025° C (short-term peak-to-peak and long-term drift combined).
Reference Temperature Accuracy: ± 0.05° C from true 0° C.
NBS Traceability: Reference Temperature Accuracy traceable to the National Bureau of Standards with certificate furnished.
Reference Temperature Indication: Cycling pilot light provides fool-proof indication that reference temperature is at 0° C.
Capacity: (a) one to four channels with provision for copper transmission lines (the positive and negative thermocouple input legs are each converted to individual copper outputs at the ice-point).
(b) one to eight channels where one leg of the measuring thermocouple is of copper (e.g. copper vs. constantan).
Thermocouple Materials: Can incorporate any mixture of T/C combinations.
Input and Output Terminals: 2150 Series -- Top mounted binding posts of thermocouple materials.
2120 Series -- Option of front panel mounted binding posts or rear mounted screw-type terminal strips (specify location when ordering).
Terminal Materials: Binding posts and terminal strips available in gold-plated copper, constantan, iron, chromel, and alumel, and used where applicable. Gold-plated copper used for all other input materials.
Environment: 2150 Series -- Convection cooled and operable at ambient temperatures between 35 - 100° F.
2120 Series -- Forced-air cooled and operable at ambient temperatures between 35 - 115° F.
Insulation Resistance: 300 megohms channel-to-channel and channel-to-ground (up to 1000 megohms available -- consult factory).
Noise: 1/2 μv peak-to-peak (typical); 1 μv peak-to-peak (maximum).
Input Power: 117 volts, 60 cycle AC, single phase.
Power Consumption: 2150 Series -- 75 watts (maximum).
2120 Series -- 100watts (maximum).
Controls: On-Off switch, cycling pilot light, fuse.
Mounting: 2150 Series -- Shelf-type.
2120 Series -- Standard 19" panel.
Dimensions: 2150 Series -- 6 3/8" wide x 11 5/8" deep x 11" high.
2120 Series -- 19" wide x 7" high; 11 7/8" depth behind panel.
Shipping Weight: 20 lbs.

RCS SERIES
ICE-POINT CALIBRATION STANDARD

"THE AUTOMATIC ICE-BATH"

The original reference system utilizing the actual equilibrium of ice and water to maintain a true ice-point reference temperature. Not a simulated device . . . fully automatic . . . ice-point maintained continuously without the deterioration typical of common ice-baths.

(patented)

WHAT IT IS

Each model maintains an immersion well (or wells) at 0°C continuously. The top of the well(s) is exposed to allow the insertion of a variety of temperature-sensing devices, thus providing a constant-temperature reference source for the sensors.

APPLICATIONS

Use as a precision absolute reference standard to CALIBRATE . . . . . .

THERMOCOUPLES

THERMOCOUPLE WIRE

or . . . . . as a REPLACEMENT for the COMMON ICE-BATH for laboratory research requiring extreme precision in temperature measurement.

Ideal for use in standards laboratories and calibration facilities.

ICE POINT

JOSEPH KAYE & COMPANY, INC.
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

FEATURES

Immersion well-type references have several advantages over thermocouple reference systems which have built-in thermocouples and thermocouple terminations.

Feature fully automatic operation, stable long-term reference temperature, maintenance-free design found in all Joseph Kaye references.

Precision . . . The ultimate in automatic reference systems. Accuracy of the Calibration Standards is solely a function of the stability at which the reference temperature is maintained. Ambient variations do not affect reference temperature stability.

Elimination of intermediate connections prevents introduction of spurious errors in the measuring circuit. Elimination of necessity for matching external wires to internal thermocouple wires precludes the introduction of secondary thermocouples in the measuring circuit.

Versatility . . . complete ease of interchangeability of elements in the calibration well . . . any combination of thermocouple material or other temperature-sensing probes can be readily interchanged.

Reference Well Cooling . . . The reference well is cooled along its length, thus effectively providing ice-point immersion for the entire stated immersion depth . . . simulates practical immersion depth of the common ice-bath or triple-point apparatus.

Reference Thermocouple Capacity . . . Several thermocouples can be inserted in the well simultaneously. However, care should be taken not to overload the well. Stated accuracy does not take into account lead conduction error of inserted probes (a function of the thermal conductivity of the inserted probes plus ambient temperature). Lead conduction error will be approximately equal to that experienced by inserting a probe of the same thermal conductivity to the same immersion depth in an ice-bath or triple-point apparatus.

SPECIFICATIONS

Number of Reference Wells: Model RCS1 -- 1
Model RCS4 -- 4
Reference Well Dimensions: Well I.D. -- 7mm
Immersion Depth -- 150mm
Reference Temperature: 0°C
Reference Temperature Indication: Cycling pilot light provides fool-proof indication that reference temperature is at 0°C
Reference Temperature Stability: ± 0.01°C (short-term peak-to-peak and long-term drift combined)
Reference Temperature Uniformity Between Wells -- RCS4: 0.005°C
Environment: Operable between ambients of 35 and 110 F
Input Requirements: 117 volts, 60 cycle AC, single phase
Power Consumption: 100 watts (maximum)
Overall Dimensions: 6 3/8" wide x 12 3/4" deep x 10 9/16" high.
Instrument Accuracy: Traceable to NBS
Continuous Duty: Once turned on will maintain 0°C reference continuously

Shipping Weight: 35 lbs

OPTIONAL REFERENCE WELL LINERS AVAILABLE

In those cases where it is desirable to electrically insulate the immersed probe from the metal walls of the reference well, insulating liners are available as follows:

(a) closed-end alumina (5mm nominal I.D.) -- Price $12 each

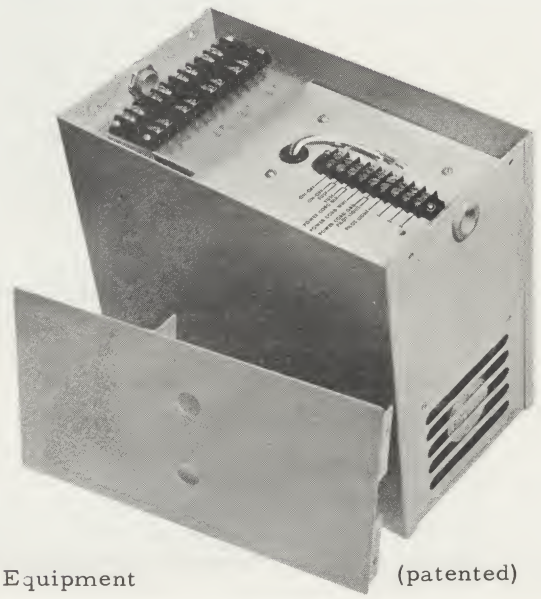
(b) various open-end multi-hole ceramic tubes for multiple wire assemblies -- consult factory

OEM SERIES
ICE-POINT THERMOCOUPLE REFERENCE SYSTEMS

"THE AUTOMATIC ICE-BATH"

The original reference system utilizing the actual equilibrium of ice and water to maintain a true ice-point reference temperature. Not a simulated device . . . fully automatic . . . ice-point maintained continuously without the deterioration typical of common ice-baths.

(Shown With Terminal Cover Removed)



(patented)

APPLICATIONS

Build Into Temperature-Measuring Equipment

- Furnace Control Systems
- Furnace Measuring Systems
- Thermal Conductivity Apparatus
- Differential Thermal Analyzers
- Calibrating Consoles
- In-Plant Calibration Carts
- Strip Chart Recording Systems
- Inspection/Quality Control Equip.

WHAT IT IS

A self-contained compact Ice-Point Reference System used primarily as a replacement for the common ice-bath.

Model OEM-10 -- maintains an immersion well at 0°C continuously. The top of the well is exposed to allow the insertion of thermocouples in a manner similar to the use of a common ice-bath.

All Other Models -- maintain built-in reference thermocouples at 0°C continuously. The reference thermocouples are terminated at thermocouple material screw-type terminal strips which provide easy connection for the user's wire.

FEATURES

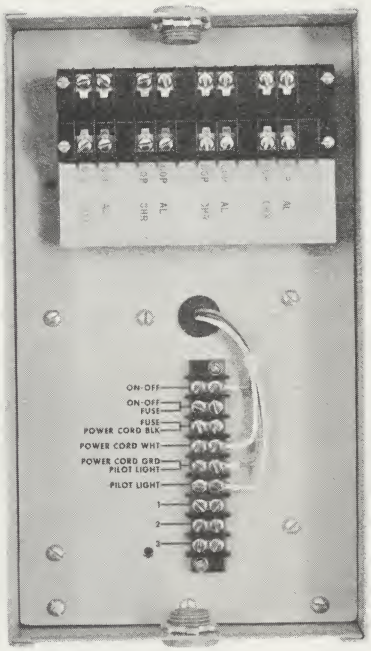
Improve the convenience and appeal of your systems by replacing the common ice-bath with this fully automatic highly accurate reference as a built-in feature.

Convenient . . . Fully Automatic . . . Highly Accurate . . . No Drift . . . Mountable in any Orientation . . . No Maintenance . . . Connect Your Choice of Controls.

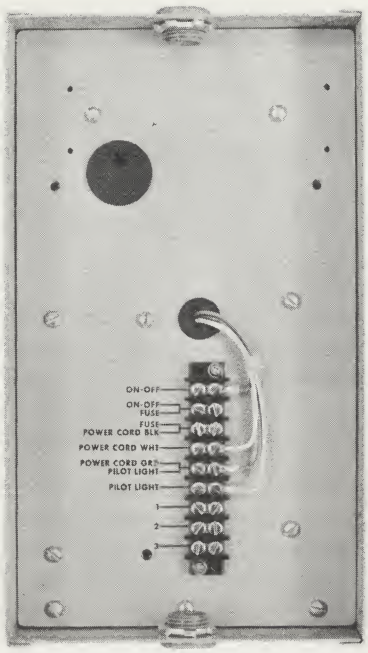
ICE POINT

JOSEPH KAYE & COMPANY, INC.
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

Model OEM-4C



Model OEM-10



(Shown Without Terminal Cover)

SPECIFICATIONS

Reference Temperature: 0°C.

Reference Temperature Stability: ± 0.025°C (short-term peak-to-peak and long-term drift combined).

Reference Temperature Accuracy: ± 0.05°C from true 0°C.

NBS Traceability: Reference Temperature Accuracy traceable to the National Bureau of Standards with certificate furnished.

Reference Temperature Indication: Terminals provided for connection of cycling pilot light which gives fool-proof indication that reference temperature is at 0°C.

Capacity: Model OEM-10 -- 1 reference well 1/4" I.D. x 6" deep. Several thermocouples can be inserted in the well simultaneously. However, care should be taken not to overload the well. Stated accuracy does not take into account lead conduction error of inserted probes. (a function of the thermal conductivity of the inserted probes plus ambient temperature). Lead conduction error will be approximately equal to that experienced by inserting a probe of the same thermal conductivity to the same immersion depth in an ice-bath or triple-point apparatus.

All Other Models -- 1 to 6 channels with provision for copper transmission lines (the positive and negative thermocouple input legs are each converted to individual copper outputs at the ice-point).

Thermocouple Materials: Model OEM-10 -- Will accept any types of T/C materials interchangeably.

All Other Models -- Any mixture of input T/C materials may be incorporated. Specify type(s) and number of each type when ordering.

Input and Output Terminals: (All models except Model OEM-10) Screw-type terminal strips. Input terminals available in matching T/C materials of constantan, iron, chromel, alumel, and gold-plated copper, and used where applicable. Gold-plated copper used for all other input materials. Output terminals all gold-plated copper.

Terminal Cover: Encloses input and output terminals to prevent air currents from creating spurious emf's in the thermocouple circuit.

Environment: Forced-air cooled and operable at ambient temperatures between 35-115°F.

Insulation Resistance: (All models except Model OEM-10) 300 megohms channel-to-channel and channel-to-ground (up to 1000 megohms available -- consult factory).

Noise: 1/2 μv peak-to-peak (typical); 1 μv peak-to-peak (maximum).

Power Consumption: 100 watts (maximum).

Controls and Electrical Connections: Terminals provided for connection of on-off switch, cycling pilot light, fuse, three conductor power cord.

Mounting: Threaded mounting holes provided on four surfaces allowing complete flexibility for mounting unit on a shelf, cabinet side, etc. Unit may be mounted in any orientation without adversely affecting its operation.

Dimensions: 6 5/8" x 12" x 10 5/8".

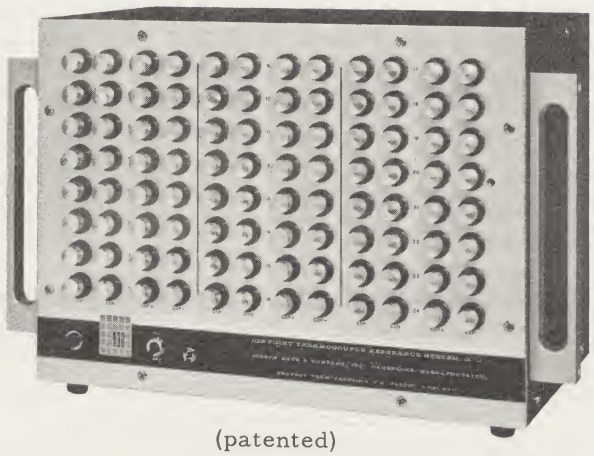
Shipping Weight: 20 lbs.

Printed In U.S.A.

PRJL SERIES
ICE-POINT THERMOCOUPLE REFERENCE SYSTEMS

"THE AUTOMATIC ICE-BATH"

The original reference system utilizing the actual equilibrium of ice and water to maintain a true ice-point reference temperature. Not a simulated device . . . fully automatic . . . ice-point maintained continuously without the deterioration typical of common ice-baths.



(patented)

APPLICATIONS

The common ice-bath, over the years, has come to be considered the 'reference standard' for thermocouple thermometry. JKCo Ice-Point Reference Systems are a modernized version of the common ice-bath and, for this reason, have gained wide acceptance as a replacement for the ice-bath. Extreme precision makes these instruments ideal for use in general laboratory research, standards laboratories, and calibration facilities.

GENERAL INFORMATION

The PRJL Ice-Point Thermocouple Reference System provides a highly accurate constant temperature reference of 0°C for use in conjunction with a laboratory-type potentiometer, galvanometer, or recorder. It is recommended for general laboratory research, standards laboratories, and calibration facilities because of its extreme accuracy and stability.

This reference system is a solid-state device, utilizing a thermoelectric (Peltier effect) cooler. The heart of the instrument is an hermetically sealed water-filled reference cell containing the reference thermocouples. The reference temperature of 0°C is established by the sustained physical equilibrium of ice and water in the reference cell. The thermoelectric cooler, automatically controlled by a bellows-microswitch sensing mechanism, maintains the correct balance of ice and water in the reference cell. Thus, the reference thermocouples are continuously surrounded by an equilibrium ice-water mixture.

ICE POINT

JOSEPH KAYE & COMPANY, INC.
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

SPECIFICATIONS

Reference Temperature: 0°C
Reference Temperature Stability: ± 0.025°C
Total Instrument Error: ± 0.05°C from true 0°C
Reference Channel Capacity: 6 through 24 channel models available
Reference Temperature Indication: Cycling pilot light provides fool-proof indication that reference temperature is at 0°C
Insulation Resistance: 300 megohms channel-to-channel and channel-to-ground (up to 1000 megohms possible -- consult factory)
Noise: 1/2 μv peak-to-peak (typical); 1 μv peak-to-peak (maximum)
Outputs: Each channel supplied with individual provision for copper transmission lines to the readout equipment
Input and Output Terminals: Binding posts of thermocouple materials
Gold-plated copper, constantan, iron, chromel, alumel used where applicable
Gold-plated copper used for all other input materials
Environment: Forced-air cooled and operable at ambients between 35 and 115 F (standard)
Automatic Heating Option: Extend operating capability below standard lower ambient limit -- consult factory
Input Requirements: 117 volts, 60 cycle AC, single phase
Power Consumption: 130 watts (maximum) with approximately 60 % duty cycle
Configuration: Metal cabinet
Terminal Cover: Encloses input and output terminals to prevent air currents from creating spurious emf's in the thermocouple circuit
Mounting: Rubber feet mounted on two surfaces for face-up or face-forward positioning
Dimensions: 20" wide x 10 3/8" deep x 12 1/8" high

Shipping Weight: 50 lbs

ORDERING PROCEDURE

Specify: (a) Model Number

(b) Type of Thermocouple Material(s)

(c) Number of Each Type

****

Obtain Ultimate Accuracy In Your Measurements -- Order Calibration Service With Your Instrument

Joseph Kaye Ice-Point Reference Systems are the most accurate automatic thermocouple references available. In order to realize the stated accuracy and stability inherent in the equipment, the user must take into account the characteristics of the wire in his T/C circuit. Commercially obtainable thermocouple wire does not match the NBS curve exactly, thus the possibility exists of mixmatch between wire incorporated in the reference system and wire used in the remainder of the circuit. Deviations from NBS Standards may be nullified if the entire installation (including reference system) is calibrated and a correction factor used. A calibration service is available for Joseph Kaye Reference Systems that provides NBS traceable correction factors for each channel which eliminate these deviations in the instrument.

Calibration Charge: $15 setup charge per instrument plus $5 per channel

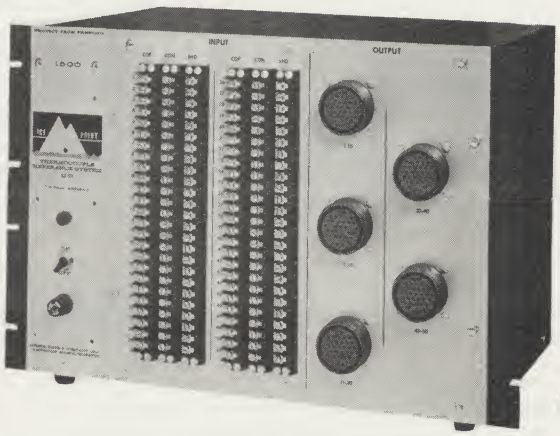
2M-666 Printed In U.S.A.

PRJR SERIES
ICE-POINT THERMOCOUPLE REFERENCE SYSTEMS

WHAT IT IS

Multi-point references for large systems instrumentation requiring the ultimate in precision

12 to 50 channel models available -- modular design permits ganging for systems requiring more than 50 points of simultaneous temperature measurement.



(patented)

APPLICATIONS

Features such as fully automatic operation, unequaled long-term reference temperature stability, maintenance-free design, extremely low noise, and low power consumption make them ideal for use in:

AUTOMATIC DATA COLLECTION SYSTEMS

INSTRUMENTATION OF TEMPERATURE-MONITORING SYSTEMS

INDUSTRIAL PROCESS CONTROL

where highly accurate temperature measurements are important.

SPECIFICATIONS

Reference Temperature: 0°C
Reference Temperature Stability: ± 0.025°C
Total Instrument Error: ± 0.05°C from true 0 C

ICE POINT

JOSEPH KAYE & COMPANY, INC.
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

Reference Temperature Indication: Cycling pilot light on all models provides fool-proof indication that reference temperature is at 0°C

Insulation Resistance: 300 megohms channel-to-channel and channel-to-ground (up to 1000 megohms possible -- consult factory)

Noise: 1/2 μv peak-to-peak (typical); 1 μv peak-to-peak (maximum)

Outputs: Each channel supplied with individual provision for copper transmission lines to the readout equipment

Input Terminals: Thermocouple material screw-type terminal strips (standard)
Gold-plated copper, constantan, iron, chromel, alumel furnished where applicable. For all other input materials contacts of gold-plated copper will be used.

Output Terminals: MS connectors containing copper contacts (standard)

Mating Output MS Cable Connectors: Containing copper contacts; with cable clamp -- (furnished as standard equipment)

Environment: Operable at ambients between 35 and 115 F (standard)

Input Requirements: 117 volts, 60 cycle AC, single phase

Power Consumption: 130 watts (maximum) with approximately 60% duty cycle

Configuration: Metal cabinet

Input Terminal Cover: Encloses input terminals to prevent air currents from creating spurious emf's in the thermocouple circuit -- (furnished as standard equipment)

Dimensions: 17" wide x 10 3/8" deep x 12 1/8" high

Shipping Weight: 50 lbs

Optional Terminal Locations: inputs and outputs front panel mounted
inputs and outputs rear panel mounted
inputs and outputs on opposite panels
Specify location when ordering. (Controls always front mounted)

Modular design permits ganging for large, multi-point systems

Thermocouple Materials: Any combination of input T/C materials may be incorporated. Specify type(s) and number of each type when ordering

Optional Mountings: Standard -- all units furnished both with rubber feet for shelf mounting and with panel flanges for 19" rack panel mounting

Wall Mount -- provided with tabs on rear of unit for bolting directly to wall

ORDERING PROCEDURE

Specify: (a) Model Number
(b) Type of Thermocouple Material(s)
(c) Number of Each Type
(d) Type of Mounting (standard, wall)
(e) Location of Input and Output Terminals

OPTIONAL FEATURES (consult factory)

Special Thermocouple Material Terminals

Water Cooling -- increase operating limit to 135 F range -- $20.00

Automatic Heating -- extend lower operating ambient limit

Shielding Circuits -- Input and output terminals with carry-through, electrically insulated from instrument -- $2.60 per channel

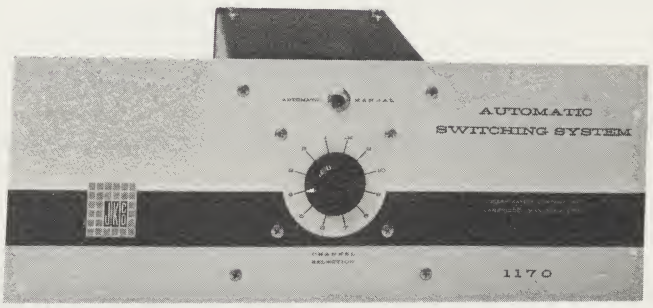
Calibration Service

Printed In U.S.A.

1170
LOW THERMAL SWITCHING SYSTEMS

APPLICATIONS

The 1170 Switching System is an electrically operated, remote controlled, instrument switch. It is designed for precision switching of up to 12 channels of thermocouple inputs into a single channel reference junction and readout instrumentation with minimum introduction of errors due to generation of thermal emf's in the switch.



Applicable to any low level instrumentation switching application, such as thermistors, similarly requiring freedom from generation of thermal emf's in the switch.

FEATURES

The system consists of a high quality, low thermal emf, rotary, instrument switch driven by a rotary stepping solenoid; an indexed front panel knob for manual operation; a rear-mounted terminal panel for all input and output thermocouple connections and for connection of electrical input to the stepping solenoid; and a front panel mounted selector switch permitting automatic stepping or manual operation.

All thermocouple elements, the instrument switch and terminal panel, are housed in an insulated, heavy-walled aluminum enclosure to provide a virtually isothermal environment. The stepping solenoid is freely ventilated to maintain safe operating temperature.

SPECIFICATIONS

Instrument Switch

Rotary, 2 deck, 12 position
Solid silver contacts with fully-enclosed wipers
Indexed knob on front panel provides for manual stepping and position indication

Operating Modes

Automatic or manual operation selectable by front panel mounted selector switch

Mode Selector Switch

Front panel mounted
"Automatic" position -- allows instrument switch to be stepped automatically
"Manual" position -- interrupts electrical stepping to permit manual positioning of instrument switch

JOSEPH KAYE & COMPANY, INC.
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

Automatic Stepping Solenoid

Input Receptacle: for connection of remote control signal circuit; rear mounted (mating plug furnished with unit)

Stepping Signal Required: 120 VAC pulse, 22-30 milliseconds duration (standard). Other voltages available on request.

Maximum Continuous Stepping Rate: 270 steps per minute (standard).

Thermocouple Input Terminals

Type: Two rear mounted 12-point screw-type terminal strips with T/C material contacts

Materials: Solid constantan, iron, chromel, alumel and gold-plated copper available and used where applicable. For all other input materials, contacts of gold-plated copper will be used.

Thermocouple Output Terminals

Type: Two rear mounted binding posts

Materials: Solid constantan, iron, chromel, alumel, and gold-plated copper available and used where applicable. For all other input materials, contacts of gold-plated copper will be used.

Dimensions

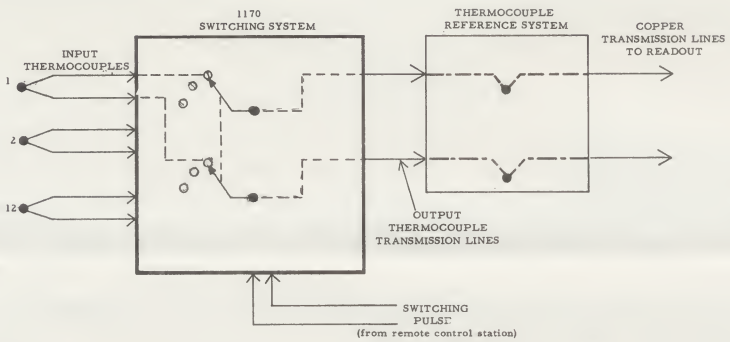
19" wide x 7" high; 11 7/8" depth behind panel

Shipping Weight -- 20 lbs

****

Requests for quotations on switching systems to meet special requirements are welcomed!

****



COMPANION THERMOCOUPLE REFERENCE SYSTEM

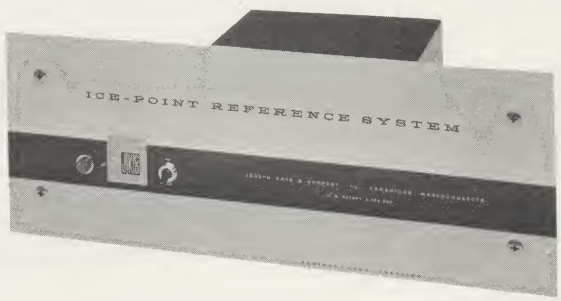
Model 2120-1C Ice-Point Thermocouple Reference

Designed specifically to mate with the 1170 Switching System

Provides a single channel reference for the two thermocouple output wires of the 1170

Its precision performance specifications compatible with the 1170

Mount both systems in common rack with the readout equipment



Reference Temperature: 0°C

Reference Temperature Stability: ± 0.025°C

Total Instrument Error: ± 0.05°C from true 0 C

Thermocouple Capacity: For converting at ice-point the two 1170 output thermocouple leads to two copper leads to the readout equipment.

T/C Input Terminals: Screw-type terminal strips containing 2 contacts of matching or compensating material -- rear mounted

Output Terminals: Screw-type terminal strips containing 2 gold-plated copper contacts -- rear mounted

Dimensions: 19" wide x 7" high; 11 7/8" depth behind panel

Environment: Ambients between 35 and 115°F

Power Required: 117 v, 60 cps; 100 watts (max)

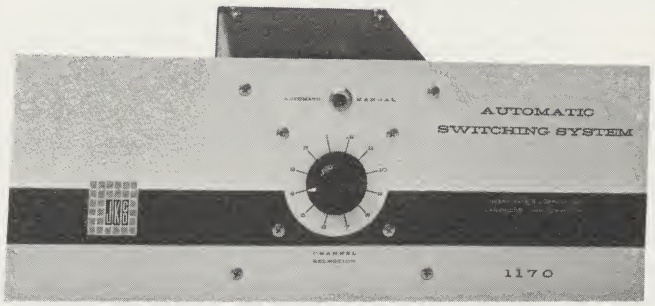
Shipping Weight: 20 lbs.

Printed In U.S.A.

1170
LOW THERMAL SWITCHING SYSTEMS

APPLICATIONS

The 1170 Switching System is an electrically operated, remote controlled, instrument switch. It is designed for precision switching of up to 12 channels of thermocouple inputs into a single channel reference junction and readout instrumentation with minimum introduction of errors due to generation of thermal emf's in the switch.



Applicable to any low level instrumentation switching application, such as thermistors, similarly requiring freedom from generation of thermal emf's in the switch.

FEATURES

The system consists of a high quality, low thermal emf, rotary, instrument switch driven by a rotary stepping solenoid; an indexed front panel knob for manual operation; a rear-mounted terminal panel for all input and output thermocouple connections and for connection of electrical input to the stepping solenoid; and a front panel mounted selector switch permitting automatic stepping or manual operation.

All thermocouple elements, the instrument switch and terminal panel, are housed in an insulated, heavy-walled aluminum enclosure to provide a virtually isothermal environment. The stepping solenoid is freely ventilated to maintain safe operating temperature.

SPECIFICATIONS

Instrument Switch

- Rotary, 2 deck, 12 position
- Solid silver contacts with fully-enclosed wipers
- Indexed knob on front panel provides for manual stepping and position indication

Operating Modes

- Automatic or manual operation selectable by front panel mounted selector switch

Mode Selector Switch

- Front panel mounted
- "Automatic" position -- allows instrument switch to be stepped automatically
- "Manual" position -- interrupts electrical stepping to permit manual positioning of instrument switch

JOSEPH KAYE & COMPANY, INC.
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

Automatic Stepping Solenoid

Input Receptacle: for connection of remote control signal circuit; rear mounted (mating plug furnished with unit)

Stepping Signal Required: 120 VAC pulse, 22-30 milliseconds duration (standard). Other voltages available on request.

Maximum Continuous Stepping Rate: 270 steps per minute (standard).

Thermocouple Input Terminals

Type: Two rear mounted 12-point screw-type terminal strips with T/C material contacts

Materials: Solid constantan, iron, chromel, alumel and gold-plated copper available and used where applicable. For all other input materials, contacts of gold-plated copper will be used.

Thermocouple Output Terminals

Type: Two rear mounted binding posts

Materials: Solid constantan, iron, chromel, alumel, and gold-plated copper available and used where applicable. For all other input materials, contacts of gold-plated copper will be used.

Dimensions

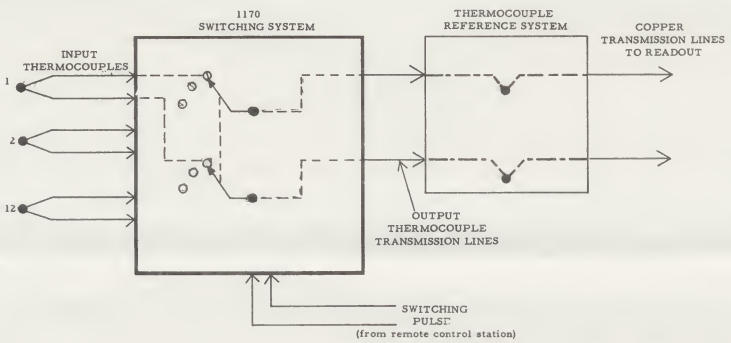
19" wide x 7" high; 11 7/8" depth behind panel

Shipping Weight -- 20 lbs

****

Requests for quotations on switching systems to meet special requirements are welcomed!

****



COMPANION THERMOCOUPLE REFERENCE SYSTEM

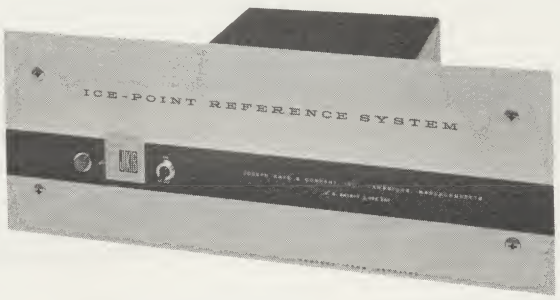
Model 2120-1C Ice-Point Thermocouple Reference

Designed specifically to mate with the 1170 Switching System

Provides a single channel reference for the two thermocouple output wires of the 1170

Its precision performance specifications compatible with the 1170

Mount both systems in common rack with the readout equipment



Reference Temperature: 0°C

Reference Temperature Stability: ± 0.025°C

Total Instrument Error: ± 0.05°C from true 0 C

Thermocouple Capacity: For converting at ice-point the two 1170 output thermocouple leads to two copper leads to the readout equipment.

T/C Input Terminals: Screw-type terminal strips containing 2 contacts of matching or compensating material -- rear mounted

Output Terminals: Screw-type terminal strips containing 2 gold-plated copper contacts -- rear mounted

Dimensions: 19" wide x 7" high; 11 7/8" depth behind panel

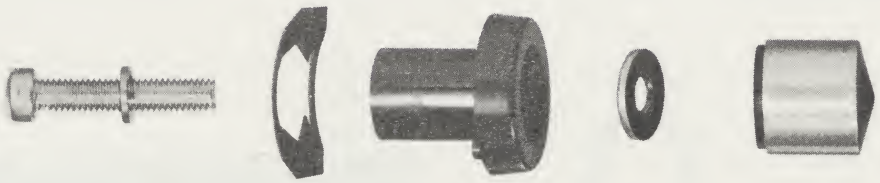
Environment: Ambients between 35 and 115°F

Power Required: 117 v, 60 cps; 100 watts (max)

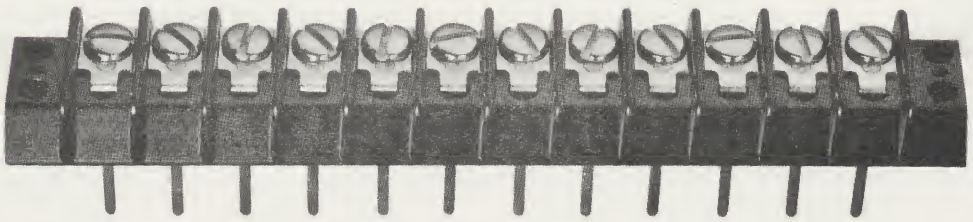
Shipping Weight: 20 lbs.

Printed In U.S.A.

THERMOCOUPLE MATERIAL
TERMINAL HARDWARE



BINDING POST



TERMINAL BLOCK

APPLICATIONS

These high quality thermocouple material binding posts and terminal blocks are designed for use on precision thermocouple instrumentation.

DESIGN FEATURES

Binding Posts

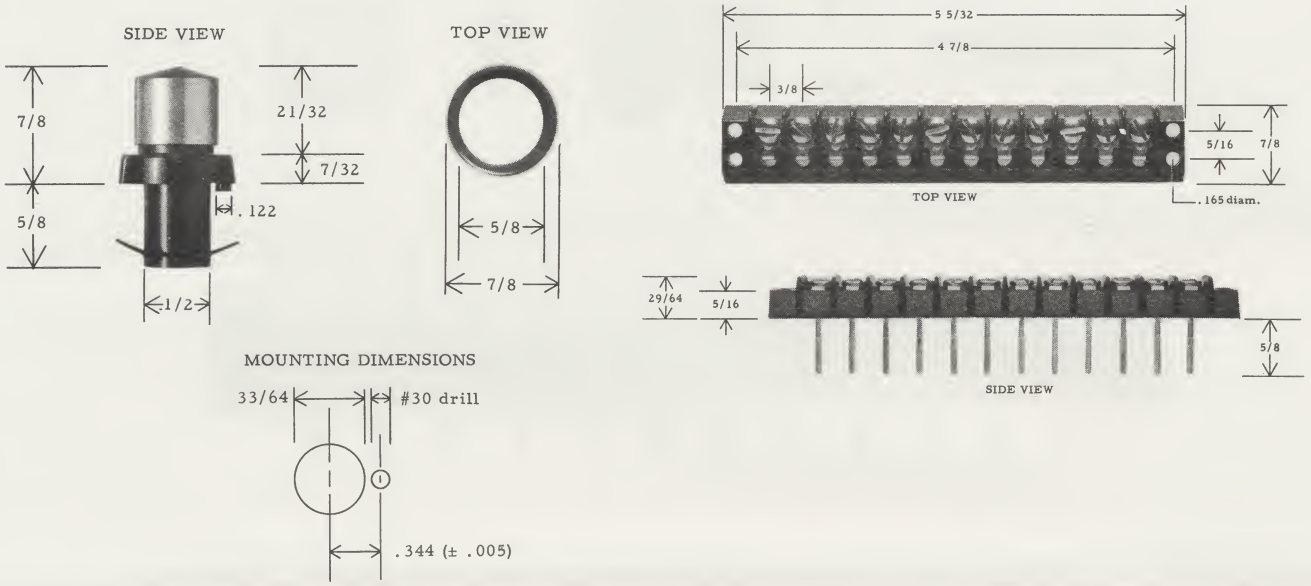
JKCo thermocouple binding posts employ a unique design feature for control of thermal emf errors. Such errors are held to a minimum by a construction which places only a thin disc of T/C material between the two T/C wires being interconnected by the binding post. No intermediate metals, such as solder, nor long terminal studs, exposed to the temperature gradients which may exist between the front and back of an instrument panel, are used. Thus, the usual error-generating elements of common binding post construction have been eliminated, even to the extent of providing non-metallic contact surfaces in the binding post knob.

WE KNOW OF NO THERMOCOUPLE TERMINALS, WHETHER BINDING POSTS, TERMINAL STRIPS, PLUGS OR CONNECTORS OF ANY TYPE, THAT ARE AS FREE FROM SPURIOUS THERMAL EMF ERRORS AS THESE BINDING POSTS! - - - They were originally designed for use on our own "Automatic Ice-Bath" thermocouple reference systems which are the most accurate automatic references on the market!

JOSEPH KAYE & COMPANY, INC.
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

Terminal Blocks

These screw-type terminal blocks are made of molded phenolic resin providing high insulation resistance between thermocouple terminal and panel. They are designed for panel feed-through wiring: each terminal has a leg protruding below the block to which the under-panel wire can be wrapped, welded, or soldered. Up to 12 points per block can be ordered from stock; larger blocks on special order. There are five T/C materials from which to choose: gold-plated copper, constantan, chromel, alumel, and iron. Any T/C material mix can be incorporated on a common block. Thus one block can contain alternating positive and negative contacts; 2 blocks can be ordered with one containing all positive, and the other all negative contacts; or blocks can be ordered containing any mix of the five materials as required. The use of copper/copper contacts is recommended for all thermocouple materials for which a matching terminal is not available.



BINDING POST SPECIFICATIONS

T/C Materials: Choice of five thermocouple contact materials: solid constantan, chromel, alumel, iron, and gold-plated copper

Insulator: Dark blue, high insulation resistant, acrylonitrile styrene copolymer

Knob: Brushed aluminum cap with threaded nylon insert. The insert provides sole knob contact with stud and T/C shoulder.

Stud: #10-32; gold-plated brass

Under-Panel Wire Size: Will accept under-panel wire of 40-22 AWG

Panel Mounting Information: For plastic or metal panels up to 1/2" thick; keying boss on insulator provides positive non-twist mounting; installation requires no special tools -- round holes used. Hand Tool Number WT150500 available for easy fastening of insulator retainer.

BINDING POST ORDERING PROCEDURE

Sold as individually packaged binding post assembly consisting of knob, stud, stud lock washer, T/C material shoulder, insulator body, insulator retainer.

Specify: (a) T/C material(s) desired
(b) Number of each type

TERMINAL BLOCK SPECIFICATIONS

T/C Materials: Choice of five thermocouple materials: solid constantan, chromel, alumel, iron and gold-plated copper

Capacity: Up to 12 contacts per block from stock; larger blocks on special order

Terminal Type: Panel feed-through

Under-Panel Wire Connection: Terminal leg accomodates solder, weld, or wire-wrap connectors

Terminal Screw: #6-32; nickel-plated brass

Block: Black, high insulation-resistant phenolic resin

TERMINAL BLOCK ORDERING PROCEDURE

Sold with contacts mounted on the block

Specify: (a) Number of blocks
(b) Number of contacts per block
(c) T/C material(s) per block
(d) Positions at which particular T/C materials are desired when a block contains more than one material

Printed In U.S.A.

ICE-POINT THERMOCOUPLE REFERENCE SYSTEM CALIBRATION SERVICE

In order to achieve maximum accuracy in thermocouple thermometry, it is necessary to calibrate the wire being used to determine the deviation of its output from that of the NBS Standard Thermocouple Tables. These tables give the standard voltage produced by various thermocouple materials as a function of the measuring junction temperature when the reference junction in the thermocouple circuit is at the equilibrium temperature of ice and air-saturated water (0°C). All thermocouple material deviates slightly from standard and should be calibrated by measuring the actual output of the thermocouple material between 0°C and some other temperatures which are known precisely, thus determining the difference between the actual output and the standard output for the given material at the known temperatures. Typically, this deviation from standard is a function of the actual output, or measuring junction temperature, and it is common practice to develop graphs or tables which give this deviation as a function of the observed voltage.

For customers who desire maximum accuracy, Joseph Kaye & Company provides a calibration service for its reference systems, the results of which are traceable to calibrations performed by the National Bureau of Standards. "Standard" thermocouples of the commonly used materials, calibrated by the National Bureau of Standards, are maintained in the calibration laboratory for the calibration of reference systems.

A reference system is calibrated by connecting the proper "standard" thermocouple to the reference system binding posts and placing the "standard" measuring junction in a carefully made, well-maintained ice-bath. The net output of this circuit is measured by instrumentation traceable to the National Bureau of Standards. The differential output thus obtained is combined with the deviation curve of the "standard" thermocouple to determine the deviation of the reference system output from that of the NBS Standard Thermocouple Tables. This value of deviation is completely traceable to calibrations performed by the National Bureau of Standards.

The deviation determined by the above procedure is the appropriate value for the specific binding post temperature which existed during the calibration procedure. The binding post temperature is assumed to be equal to the ambient temperature measured near the reference system, and under normal ambient conditions this assumption introduces a negligible error in the final results.

While it would be possible to obtain deviations from standard at a number of different ambient temperatures and to develop a deviation curve, the characteristics of the wire employed in Joseph Kaye & Company's reference systems are sufficiently linear in the room temperature range to permit the assumption of a linear deviation curve. This assumption makes it possible for the customer to employ a single correction factor given in terms of microvolts per degree of ambient temperature.

The deviation from standard of the wire employed in the reference system is by far the major factor which causes the output of a Joseph Kaye & Company reference system to deviate from the NBS standard output. The calibration factor not only accounts for this deviation, however, but corrects for all instrument errors. Thus, when the correction factor is applied, the output of a Joseph Kaye & Company reference system will have a total maximum deviation from NBS standard output of less than 0.05°C.

Calibration Charge: $15 setup charge per instrument plus $5 per channel

JOSEPH KAYE & COMPANY, INC.
737 Concord Avenue · Cambridge, Massachusetts 02138
Tel: 617-868-7080 TWX: 617-499-9154

4M-666 Printed In U.S.A.

effective February, 1967

MODEL AND PRICE LIST

Reference Systems

Model Number	Number of Channels	With Copper Trans. Lines	Price
OEM Series			
OEM-10			355.
OEM1	1		370.
OEM1C	1	X	380.
OEM2	2		380.
OEM2C	2	X	405.
OEM3	3		395.
OEM3C	3	X	430.
OEM4	4		405.
OEM4C	4	X	455.
OEM5	5		420.
OEM5C	5	X	480.
OEM6	6		430.
OEM6C	6	X	505.
OEM7	7		445.
OEM8	8		455.
OEM9	9		470.
OEM10	10		480.
OEM11	11		495.
OEM12	12		505.
2100 Series			
2110			330.
2150-1	1		385.
2150-1C	1	X	395.
2150-2	2		400.
2150-2C	2	X	420.
2150-3	3		415.
2150-3C	3	X	445.
2150-4	4		430.
2150-4C	4	X	470.
2150-5	5		445.
2150-6	6		460.
2150-7	7		475.
2150-8	8		490.
2120-1	1		445.
2120-1C	1	X	455.
2120-2	2		460.
2120-2C	2	X	480.
2120-3	3		475.
2120-3C	3	X	505.
2120-4	4		490.
2120-4C	4	X	530.
2120-5	5		505.
2120-6	6		520.
2120-7	7		535.
2120-8	8		550.
RCS Series			
RCS1			495.
RCS4			550.
Liners			12.
PRJL Series			
PRJL6C	6	X	970.
PRJL7C	7	X	995.
PRJL8C	8	X	1,020.
PRJL9C	9	X	1,045.
PRJL10C	10	X	1,070.
PRJL11C	11	X	1,095.
PRJL12C	12	X	1,120.
PRJL13C	13	X	1,145.
PRJL14C	14	X	1,170.
PRJL15C	15	X	1,195.
PRJL16C	16	X	1,220.
PRJL17C	17	X	1,245.
PRJL18C	18	X	1,270.
PRJL19C	19	X	1,295.
PRJL20C	20	X	1,320.
PRJL21C	21	X	1,345.
PRJL22C	22	X	1,370.
PRJL23C	23	X	1,395.
PRJL24C	24	X	1,420.
PRJR Series			
PRJR12C	12	X	975.
PRJR24C	24	X	1,235.
PRJR36C	36	X	1,495.
PRJR48C	48	X	1,755.
PRJR50C	50	X	1,795.

UTR . . . . . 890.

1170 Switching System . . . . . .740.

Binding Posts . . . $2./each 12 Contact Terminal Blocks . . . $6.25/each
Hardware Quantity Discount: 1 - 24, net; 25 - 49, 5%; 50 - 99, 10%; 100 and over, 15%
Hand Tool #WT150500 for installing binding post retainer $16.50
Minimum Order: $15.

Export: Modification for 240 volt, 50 cps line current -- $50. (U.S. funds)

Terms: Net 30 days F.O.B.: Cambridge, Mass. with shipping charges added to invoice.

Joseph Kaye & Company reserves the right to make changes in specifications for reasons of improved design. Your inquiries for reference systems to meet your special requirements are invited.